

# PATENT ABSTRACTS OF JAPAN

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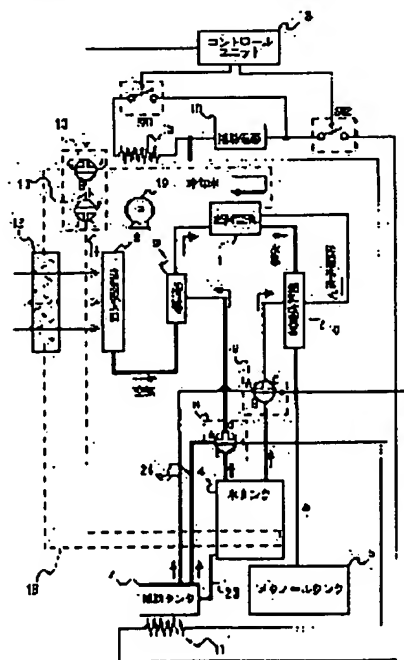
## (54) POWER GENERATION SYSTEM FOR ELECTRIC VEHICLE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent the coagulation of humidifying water even under a low temperature environment and thereby to stably start a power generation system by composing a water tank for feeding to a humidifying means for fuel gas and oxidizer gas to be fed to a pair of electrodes interposed with an ion conductive film of a fuel cell, with a main tank and a stand-by tank having smaller capacity than the main tank capacity and having a heat insulation structure.

**SOLUTION:** A humidifier 3 is connected to a water tank 4 for supplying water to be sprayed into the air, and water for generating hydrogen by reacting with methanol in a fuel reformer 6, and to an auxiliary tank 7, and is switched by three-way valves 8, 9 controlled by

controller 18 that senses the temperature of a fuel cell 1. The controller 18 turns on a switch SW2 at the startup time, and a heater 11 heats the auxiliary tank 7 by an auxiliary power supply 10 to melt coagulated water for feeding. Cooling water circulating a bypass 17 by turning on a switch SW1 at the startup and heated by a heater 15 heats the inside of the fuel cell 1 and the periphery of the water 4, and water is fed from the water tank 4 after an output in stabilized.



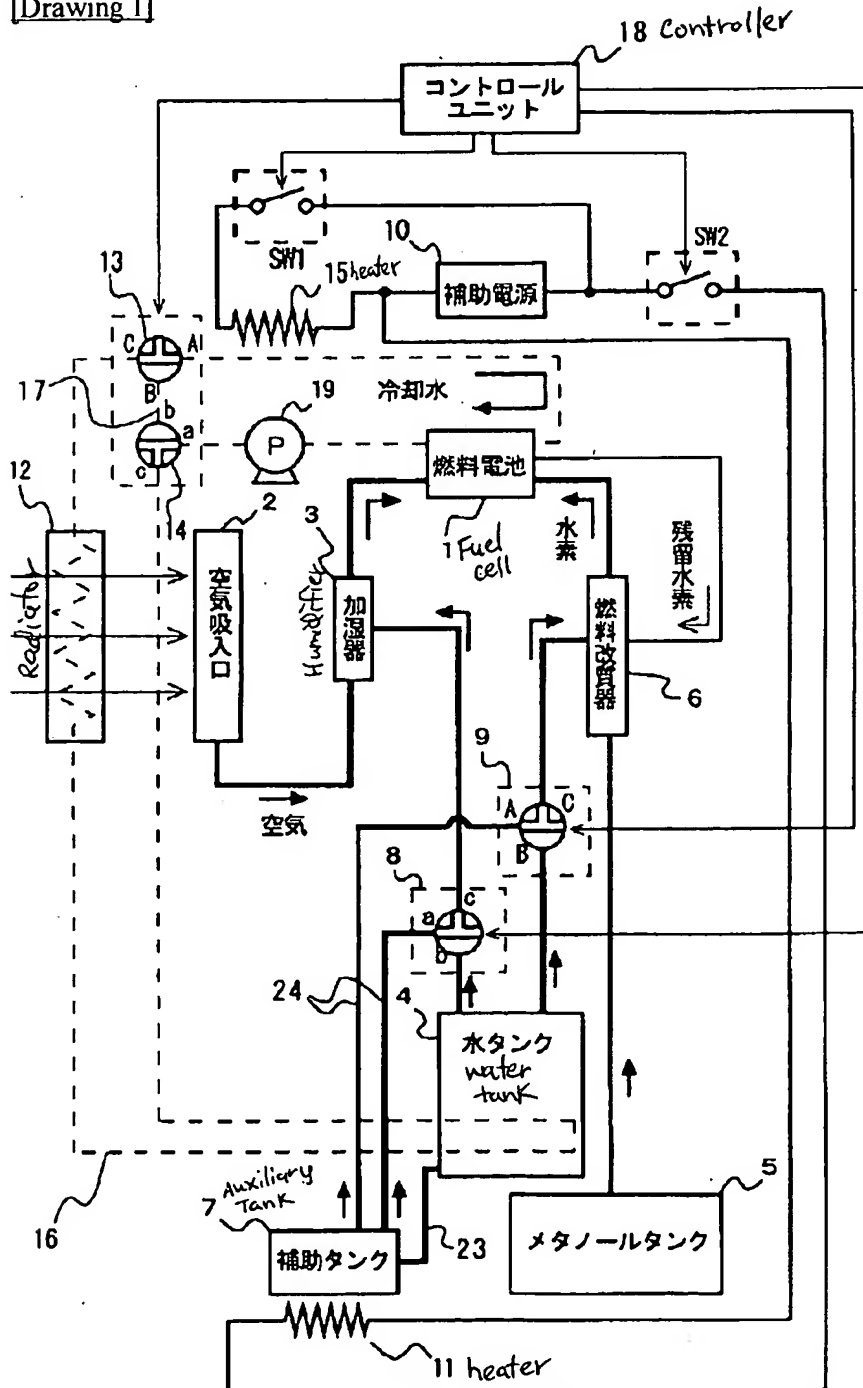
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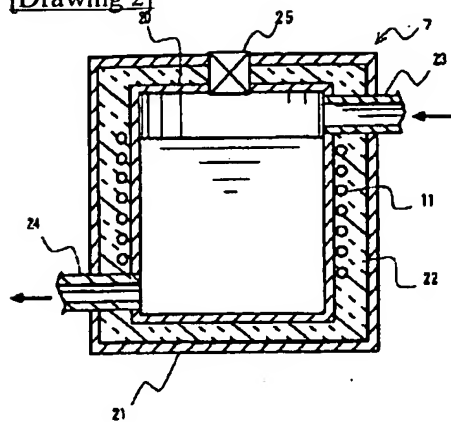
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DRAWINGS

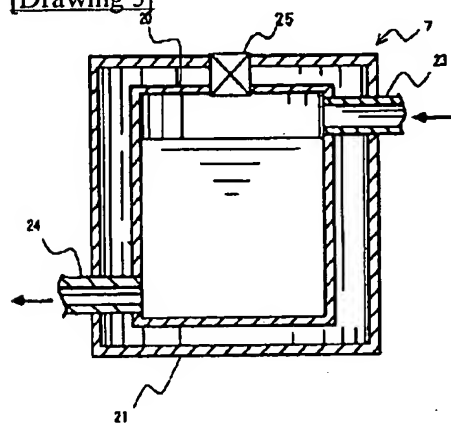
[Drawing 1]



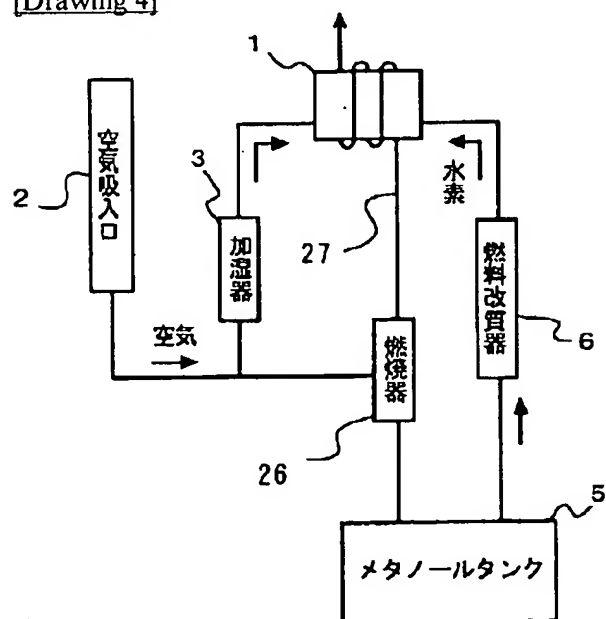
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates especially to the starter style about the generation-of-electrical-energy system of the electric vehicle which used the fuel cell.

[0002]

[Description of the Prior Art] In recent years, the expectation for an electric vehicle is growing from the clean energy-oriented rise. Until now, the electric vehicle which made rechargeable batteries, such as a rechargeable lithium-ion battery, a nickel-hydrogen rechargeable battery, and a lead acid battery, the source of power has been developed. However, it is a practical big trouble that cell weight becomes large in order for the electric vehicle using these rechargeable batteries to obtain the output of that charge takes long duration, that capacity is small and mileage is short, and a request etc. So, in recent years, development of the electric vehicle which made the fuel cell which replaces with a rechargeable battery and is generated with a fuel the source of power is performed actively. A fuel cell generates power by supplying the hydrogen as fuel gas to one side of the electrode arranged on both sides of the ion conductivity film, supplying the oxygen as oxidizer gas to the electrode of another side, and making these react. The hydrogen as fuel gas is obtained by making a methanol react with water under an elevated temperature. Thus, according to the fuel cell, since liquid fuel can be used like an internal combustion engine, supply of a fuel is attained like the automobile using the conventional internal combustion engine for a short time. Moreover, it is possible to obtain the mileage which is not different from the automobile conventional by one-time refueling depending on the capacity of the fuel tank of an automobile.

[0003] In order to prevent degradation of the ion conductivity film, a steam is mixed by the fuel gas and oxidizer gas which are supplied to the two poles of a fuel cell, respectively, respectively. When making a methanol and water react with a fuel reforming vessel to hydrogen gas and making hydrogen generate to it, many steams are added to generation of hydrogen rather than a complement. Water is directly sprayed on air. A fuel cell needs supply of water as mentioned above. Moreover, the stable output will not be obtained if own temperature of a cell is low. However, in order to use a fuel cell as a source of power of an electric vehicle, it is necessary to guarantee starting which was not concerned with the environment but was stabilized.

[0004]

[Problem(s) to be Solved by the Invention] This invention solves the above trouble, prevents the coagulation of the humidification water under low temperature, and aims at offering the generation-of-electrical-energy system for electric vehicles which can be stabilized and put into operation under low-temperature environments, such as a cold district.

[0005]

[Means for Solving the Problem] This invention forms the tank of the reserve equipped with the heating function or the incubation function apart from the tank which stores the water supplied to a fuel cell. Moreover, the means for heating these separately is established to the coagulation of the water in a fuel cell etc.

[0006]

[Embodiment of the Invention] The fuel cell possessing the ion conductivity film which made the generation-of-electrical-energy system for electric vehicles of this invention intervene between the electrode of a pair, and two electrodes, A fuel gas supply means to supply fuel gas to one electrode of a fuel cell, and an oxidizer gas supply means to supply oxidizer gas to the electrode of another side of a

fuel cell, The fuel gas humidification means for humidifying fuel gas, and the oxidizer gas humidification means for humidifying oxidizer gas, It has the water tank which holds the water for supplying a fuel gas humidification means or an oxidizer gas humidification means, and capacity of a water tank is smaller than a main tank and a main tank, and it possesses the reserve tank which has a thermal protection structure.

[0007] The fuel cell possessing the ion conductivity film which made other generation-of-electrical-energy systems for electric vehicles of this invention intervene between the electrode of a pair, and two electrodes, A fuel gas supply means to supply fuel gas to one electrode of a fuel cell, and an oxidizer gas supply means to supply oxidizer gas to the electrode of another side of a fuel cell, The fuel gas humidification means for humidifying fuel gas, and the oxidizer gas humidification means for humidifying oxidizer gas, It has the water tank which holds the water for supplying a fuel gas humidification means or an oxidizer gas humidification means, and capacity of a water tank is smaller than a main tank and a main tank, and it possesses the reserve tank which has a heating means to heat the held water.

[0008] The generation-of-electrical-energy system for electric vehicles of further others of this invention The fuel cell possessing the ion conductivity film made to intervene between the electrode of a pair, and two electrodes, A fuel gas supply means to supply fuel gas to one electrode of a fuel cell, and an oxidizer gas supply means to supply oxidizer gas to the electrode of another side of a fuel cell, The fuel gas humidification means for humidifying fuel gas, and the oxidizer gas humidification means for humidifying oxidizer gas, It has the water tank which holds the water for supplying a fuel gas humidification means or an oxidizer gas humidification means, and has further a heating means to heat the duct which connects a fuel cell, each means, or each means.

[0009] What has the heating element which generates heat with a power source and its output can be used for the above-mentioned heating means. Preferably, a rechargeable battery is used for a power source. Especially, it is desirable the output of a fuel cell and to especially conserve the output of the surplus after fuel supply interruption with a rechargeable battery. Moreover, a heating means to burn liquid fuel and to generate heat can also be used. In heating of a fuel cell, if the cooling water made to circulate through the inside of a fuel cell is heated, the water effectively solidified in the interior can be dissolved. Moreover, since a fuel cell can be heated effectively, the output of a fuel cell can be stabilized for a short time. Each means or duct which it is going to heat near the path of the cooling water heated by making it desirable in this way is allotted, and these are heated by heat dissipation of this cooling water.

[0010]

[Example] Hereafter, the desirable example of this invention is explained to a detail using a drawing.

[0011] The fuel cell generation-of-electrical-energy structure of a system of this example is shown in drawing 1 . A fuel cell 1 makes hydrogen and the oxygen in the air inhaled from the system outside react, and is generated. The air supplied to a fuel cell 1 is adopted in a system from the air-suction-system opening 2 ahead arranged to the travelling direction of a car. A humidifier 3 sprays the water held in the air adopted in the system by the water tank 4, and supplies this humidified air to a fuel cell 1. The methanol tank 5 holds the methanol which is a fuel for generating electricity. The fuel reforming machine 6 makes the methanol held in the methanol tank 5, and the water held in the water tank 4 react under an elevated temperature, and makes hydrogen gas generate. The hydrogen gas generated in the fuel reforming machine 6 is supplied to a fuel cell 1. In addition, the hydrogen which was not consumed with a fuel cell 1 returns to the fuel reforming machine 6.

[0012] It connects with the water tank 4 and the auxiliary tank 7 is always storing about 1l. water. A control unit 18 controls cross valves 8 and 9, and changes the source of supply of the water linked to a humidifier 3 and the fuel reforming machine 6 between a water tank 4 and an auxiliary tank 7. At the time of normal operation, the water supplied from a water tank 4 is supplied to a humidifier 3 and the fuel reforming machine 6, respectively, and the water stored in the auxiliary tank 7 is supplied to a humidifier 3 and the fuel reforming machine 6, respectively at the time of starting of a fuel cell generation-of-electrical-energy system and \*\*\*\* of a water tank 4. A heater 11 heats an auxiliary tank 7 with the output of auxiliary power 10 at the time of starting of a system. The fuel cell 1 is connected with the radiator 12 in the duct 16, and with a pump 19, as the drawing Nakaya mark shows, cooling water circulates through a duct 16. The duct 16 is allotted so that a water tank 4 may be adjoined. Cross valves 13 and 14 operate by control of a control unit 18, and make a bypass 17 circulate through cooling water. The radiator 12 is arranged on the upstream of the air-suction-system opening 2, and the air heated by the radiator 12 flows into the air-suction-system opening 2. A heater 15 heats the cooling

water which circulates a duct 16 with the output of auxiliary power 10.

[0013] Next, actuation of this generation-of-electrical-energy system is explained. At the time of starting, a control unit 18 connects between A-B of a cross valve 13, and between a-b of a cross valve 14, turns ON a switch SW1 further, and operates a heater 15. This circulates through the cooling water which passed the fuel cell 1 through a bypass 17 to a radiator 12, without flowing. That is, the inside of a fuel cell 1 is circulated, being heated at a heater 15. A fuel cell 1 is heated with the cooling water heated by doing in this way, and dissolves the water solidified inside the fuel cell 1. If a control unit 18 judges that the temperature of a fuel cell 1 was detected and the fuel cell 1 was fully heated, it will switch cross valves 13 and 14, and will connect between A-C of a cross valve 13, and between a-c of a cross valve 14. Thereby, the heated cooling water circulates the perimeter of a water tank 4, and heats a water tank 4. If it judges that the water solidified in the water tank 4 dissolved completely with this heating, a control unit 18 will turn OFF a switch SW1, and will suspend heating at a heater 15. In addition, since a water tank 4 is large capacity, long duration is required for dissolving all the water in the tank solidified completely. Therefore, after the output of a fuel cell 1 is stabilized, supply of the water from the water tank 4 to a humidifier 3 and the fuel reforming machine 6 is started.

[0014] At the time of starting, a control unit 18 turns ON a switch SW2 further. Thereby, a heater 11 generates heat, heats an auxiliary tank 7, and dissolves the water solidified within the tank. Therefore, supply of the water to a humidifier 3 and the fuel reforming machine 6 is attained from an auxiliary tank 7. A control unit 18 detects the temperature in an auxiliary tank 7, if the water held in the interior has not solidified, it connects between a-c of a cross valve 8, and between A-C of a cross valve 9, starts supply of the water from the auxiliary tank 7 to a humidifier 3 and the fuel reforming machine 6, and turns OFF a switch SW2 further. Thereby, the generation of electrical energy by the fuel cell 1 is started. If what the water in a water tank 4 dissolved is checked, a control unit 18 will connect between b-c of a cross valve 8, will connect between B-C of a cross valve 9 further, and will start supply of the water from a water tank 4.

[0015] The water solidified within the fuel cell 1 as mentioned above is dissolved, and it becomes possible to secure water still more nearly required for starting. Moreover, since self has an exoergic device, the fuel reforming machine 6 can dissolve easily the water solidified in the interior. However, it is difficult to dissolve the water solidified within piping for supplying water to the interior and these devices of a humidifier 3. Then, humidifiers 3 and these piping are allotted near the duct 16 where the heated cooling water as well as a water tank 4 circulates, and it is made to dissolve the water solidified inside in response to the heat from a duct 16. Of course, it may allot near the heater 11 or the heater for heating etc. may be arranged separately.

[0016] The outline of an auxiliary tank 7 is shown in drawing 2. An auxiliary tank 7 has the internal container 20 for holding water. It unites with the auxiliary tank 7 and the heater 11 is wound around the side face of the internal container 20. Between the internal container 20 and the outside can 21, it fills up with the heat insulator 22 so that the heat of a heater 11 may not leak to the exterior of an auxiliary tank 7. The internal container 20 is connected with the water tank 4 by the duct 23. Moreover, the internal container 20 is connected with cross valves 8 and 9 by the duct 24, respectively. The pressure in a tank is uniformly held by the open valve 25. In addition, instead of using a heater, the methanol which is a fuel is burned in heating of a water tank 4, and the heat may be used for it. Moreover, there is almost no possibility that the water in the above water tanks 4 will solidify completely under an operating environment to which an OAT does not fall to about several [ below the freezing point ] degrees C. Then, it is not necessary to necessarily establish the heating device of the above auxiliary tanks 7. For example, the so-called thermos bottle structure as shown in drawing 3 may be adopted. That is, the coagulation of the water in a tank can be prevented by making space between the internal container 20 and the outside can 21 into a vacuum, and intercepting the internal container 20 thermally with the open air.

[0017] A heater can also be used about heating of a fuel cell 1 as well as heating of an auxiliary tank 7. Moreover, as shown, for example in drawing 4, a methanol is burned with the combustor 26 connected to the methanol tank 5, and it can also heat with the heat transfer from the exhaust pipe 27. In addition, a rechargeable battery is used for auxiliary power 10, the output of a fuel cell 1 is stored in it, and you may make it output to heaters 11 and 15. Generally, since an output is continued for a while even if a fuel cell suspends supply of fuel gas or oxidizer gas, it is desirable on energy efficiency to conserve the power of this surplus.

[0018]

[Effect of the Invention] According to this invention, the fuel cell generation-of-electrical-energy system

which can be stabilized and put into operation also under low-temperature environments, such as a cold district, can be offered.

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[Translation done.]